ANALYSIS OF VARIABLE QUARTERLY FORECAST

DEPARTMENT OF DEFENSE

DEFENSE LOGISTICS AGENCY

Cameron Station,
Alexandria, Virginia 22304-6100

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The Defense Industrial Supply Center (DISC) is the only DLA Supply Center that uses a Variable Quarterly Forecasted (VQF) Support by Supply Management Category Codes (SMCC) methodology as a tool to manage their resources. DISC experiences lower supply availability than the other DLA Supply Centers. This analysis was initiated to determine what impact use of the VQF methodology has had on costs and peformance at DISC. Based upon a comparative assessment between the SAMMS requirements determination process and the VQF methodology, the VQF requires lower investment costs to achieve the same overall system performance as SAMMS.

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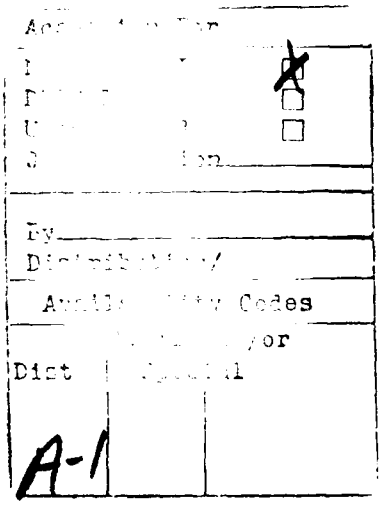

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FOREWORD

The Defense Industrial Supply Center (DISC) is the only Center that uses a Variable Quarterly Forecasted (VQF) Support by Supply Management Category Codes (SMCC) methodology as a tool to manage their resources. DISC experiences lower supply availability than the other DLA Supply Centers (DSCs). This analysis was initiated to determine what impact use of the VQF methodology has had on costs and performance at DISC. Based upon a comparative assessment between the SAMMS requirements determination process and the VQF methodology, the VQF requires lower investment costs to achieve the same overall system performance as SAMMS. Lower supply performance at DISC is not attributable to their use of VQF. Due to the DISC impact on overall DLA performance, increasing performance at DISC would improve the overall performance of DLA. Consideration should be given to reassessing and evaluating other areas of operation at DISC.

ROGER C. ROY
Assistant Director
Policy and Plans

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I. INTRODUCTION. Since the mid 1970's, the Defense Industrial Supply Center (DISC) has used a Variable Quarterly Forecasted (VQF) Support by Supply Management Category Codes (SMCC) methodology as a tool to manage their resources. Use of this methodology is unique to DISC. Across all commodities, DISC manages the greatest number of items, processes the largest number of requisitions, and experiences the lowest supply availability.

A. Background. Use of the VQF is a result of work performed by the DISC Operations Research Team. In an attempt to address the need to maximize supply availability subject to constraints on system investment dollars and total buyer manhours the Operations Research Team developed a resource allocation model called the Gradient Inventory Model (GIM). GIM is a non-linear optimization model which determines the optimal distribution of resources to item groups based upon item characertistics. The methodology of VQF was developed as a means of implementing the optimized results from GIM. Application of the VQF support factors to the QFD recorded in SAMMS allows the computation of requirement levels to approximate the optimized support levels determined by GIM.

B. Problem Statement. Compared with the other DLA commodities, DISC has experienced supply performance problems for the last several years. What impact has the application of the VQF methodology made on DISC's management and performance?

C. Objective. Our objective in this study was to compare the impacts on cost and effectiveness between the SAMMS requirements determination process and the application of the VQF methodology.

D. Scope. Our investigation was limited to an analysis of replenishment demand items. Demand data, both forecasted and actual, beginning in FY86 was used. The SMCC and VQF support factors applied at any given time during the period were also used.

II. CONCLUSIONS

Given the same constraints and operational scenarios, the VQF methodology out performs the standard SAMMS requirements determination process. The VQF can achieve the same overall system performance as SAMMS with lower investment costs.

DISC's contribution to the overall DLA supply performance (in terms of requisition volume) far exceeds that of the other hardware centers. This suggests that a large increase in availability at DISC might be achieved at the expense of small reductions in availability at the other Centers, resulting in higher overall DLA performance.

III. RECOMMENDATIONS

DISC should continue use of the VQF methodology. However, due to the significant impact on overall DLA performance, consideration should be given to investigate and evaluate other areas of operation at DISC which affect supply availability.

IV. BENEFITS. Continued use of the VQF offers improved supply performance by optimal allocation of resources to selected item groupings under any operational scenario. Current VQF operations require approximately $5M less in dollar value of average stock on hand while providing the same level of supply performance as SAMMS. Due to the DISC impact on overall DLA performance, increasing performance at DISC would improve the overall performance of DLA.

V. METHODOLOGY. The initial emphasis of this study was to assess the cost and effectiveness of the VQF methodology with regard to DISC supply performance. We began by investigating three major areas concerning the SMCC and VQF methodology. First, we evaluated the actual SMCC categories and the impact on projected system demands of applying the VQF factors to each item in the categories. Second, the impacts on both projected system costs and performance between the SAMMS and VQF requirements determinations were assessed. After a comparative analysis of both the SAMMS and VQF methodology against actual historical demand, we extended our analysis to include an assessment of current operating levels, system changes required to increase supply availability, and the contribution of DISC workload to the overall DLA system.

VI. ANALYSIS

A. Supply Management Category Codes. Each Defense Supply Center defines SMCCs differently and uses these categorizations to aid in the management of thousands of items. The SMCCs group items with similar characteristics such as annual demand values and demand frequencies. The SMCC categories in effect at DISC on 1 January 1988 are displayed in Figure 1.

The 24 categories displayed allow for selected management of weapon system versus non-weapon system items. Instead of using static annual demand frequency categories for all annual demand value categories, DISC assigns varying demand frequency groupings based on historical distributions. The SMCC is used as a means of implementing the VQF methodology.

Figure 1

VQF SUPPORT FACTORS
for DISC Supply Management Category Codes
1 JAN 1988

ADV GROUP	WPNS SYS CODES X AND Y			WPNS SYS CODES Z AND N		
	HIGH FREQ	MED FREQ	LOW FREQ	HIGH FREQ	MED FREQ	LOW FREQ
	1	2	3	13	14	15
VIP >$50,000	1.25	1.25	.90	1.20	1.10	.70
	4	5	6	16	17	18
HIGH >$4,500	1.00	.90	.85	1.20	.70	.70
	7	8	9	19	20	21
MED $400-$450	1.30	1.05	.85	1.20	.75	.70
	10	11	12	22	23	24
LOW 0-$400	1.25	1.00	1.00	1.15	1.00	1.00

The application of the VQF factors derived from GIM to an item's quarterly forecasted demand affects the buy, safety level, and leadtime quantities. In Figure 2, we compare the average ratios of variable quarterly forecasted demand (VQFD) and the QFD of record in SAMMS to the actual demand for each SMCC over six different quarters.

Increases in forecasted demands caused by apply VQF support factors greater than 1 to items in a SMCC, forces increased support to items in those categories. Therefore, the VQF is concentrating resources on first, high demand frequency weapon system items; second, high demand frequency items; and third, low dollar items. The ability to satisfy demand for weapon system items contributes to military readiness. Supply availability is measured in terms of number of requisitions filled. The ability to support high demand frequency items contributes to higher supply availability.

Figure 2

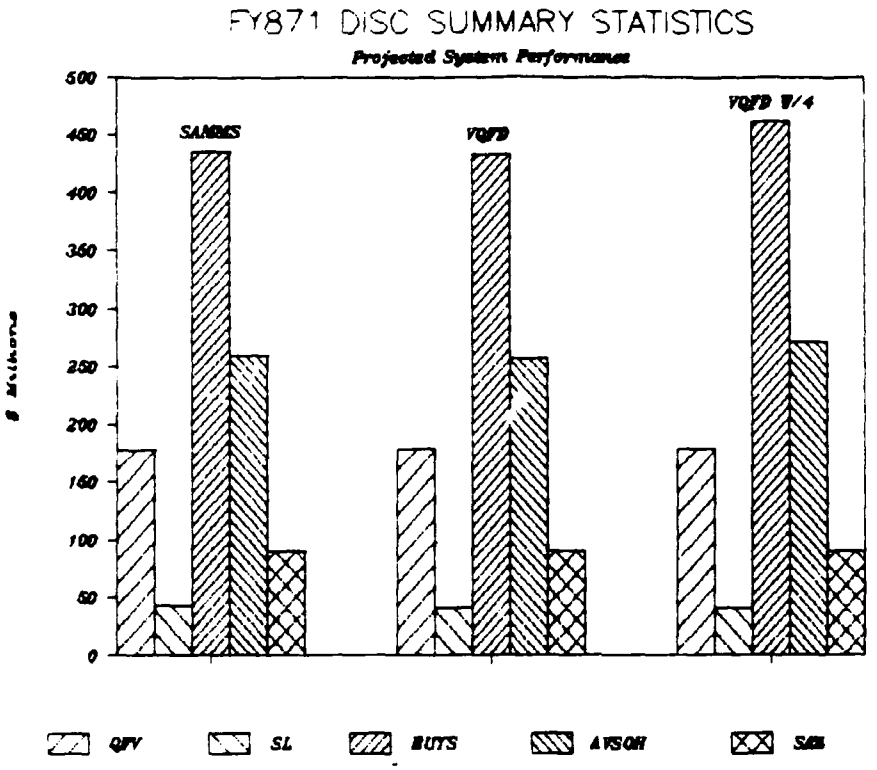
COMPARISON OF FORECASTED DEMANDS TO ACTUAL DEMAND

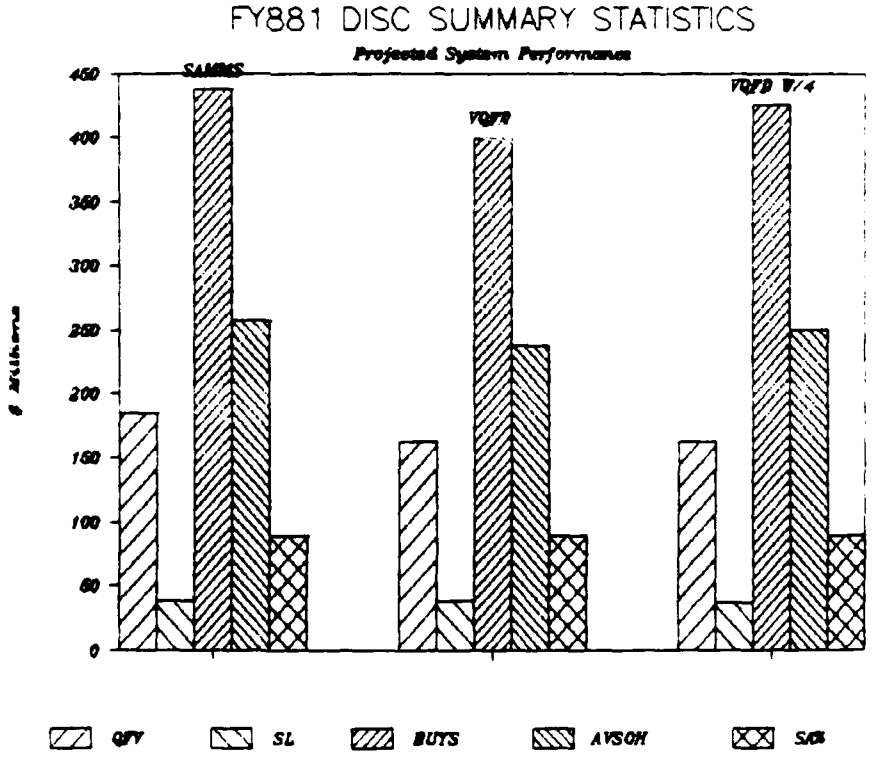
Average Ratio of Forecast to Demand, FY87-FY88

ADV GROUP	WPNS SYS CODES X AND Y			WPNS SYS CODES Z AND N			
	HIGH FREQ	MED FREQ	LOW FREQ	HIGH FREQ	MED FREQ	LOW FREQ	
	1	2	3	13	14	15	
VIP >$50,000	1.00	1.02	0.95	Ratios not computed due to high degree of item migration in these categories			AVG Ratio QFD/DMD
	1.28	1.28	0.98				AVG Ratio VQFD/DMD
	4	5	6	16	17	18	
HIGH >$4,500	1.04	0.95	0.99	0.95	1.11	0.97	AVG Ratio QFD/DMD
	1.18	0.99	0.91	1.07	0.94	0.76	AVG Ratio VQFD/DMD
	7	8	9	19	20	21	
MED $400-$450	1.02	0.98	1.00	0.98	0.95	1.01	AVG Ratio QFD/DMD
	1.41	1.23	0.97	1.18	0.88	0.79	AVG Ratio VQFD/DMD
	10	11	12	22	23	24	
LOW 0-$400	1.01	1.00	1.08	1.05	0.96	1.25	AVG Ratio QFD/DMD
	1.37	1.17	1.10	1.16	0.94	1.25	AVG Ratio VQFD/DMD

B. Comparison of Projected System Performance. An analytical model was developed to obtain steady state projections of system performance for both the SAMMS methodology and the VQF methodology. We wanted to compare the projections of supply performance and dollar requirements for each of these techniques. The SAMMS methodology retains the QFD of record. The VQF methodology uses the VQFD obtained by applying the variable support factors to the QFD of record. DISC began using a minimum EOQ buy of 4 months of demand in 1988. For our analyses using FY881 as the base year, we ran the VQF methodology using both the standard 3 month minimum buy and the 4 month minimum buy. Performance was measured in terms of projected dollar investment required to achieve the same level of supply availability. Figure 3 displays the comparative results using FY871 and FY881 as the base years for steady state projections.

Figure 3

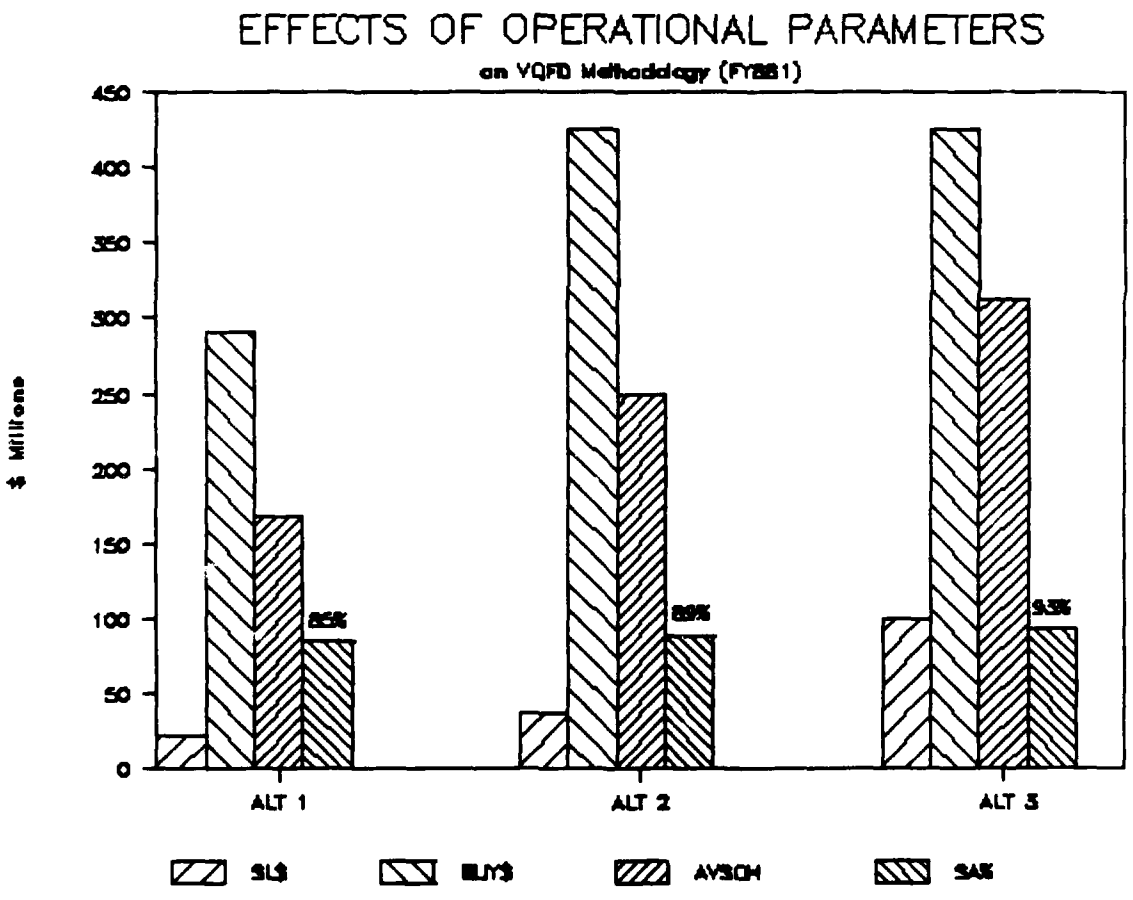

FY871 DISC SUMMARY STATISTICS
Projected System Performance
500
450
400
350
300
250
200
150
100
50
0
SAMMS
VQFD
VQFD W/4
QFV
SL
BUTS
AVSOH
SUS


FY881 DISC SUMMARY STATISTICS
Projected System Performance
450
400
350
300
250
200
150
100
50
0
SAMMS
VQFD
VQFD W/4
QFV
SL
BUTS
AVSOH
SUS

Each methodology tested achieves the same supply availability percentage. However, in all scenarios, the VQF methodology realizes lower dollar investments in both safety level and commitments. In the FY881 analysis, the SAMMS methodology required $256.6 M dollars average stock on hand compared with $249.6 M for the VQF with a minimum 4 month EOQ buy.

Operational parameters such as backorder lines on hand goal, safety level ceilings, and EOQ T-factors affect system performance. By decreasing our backorder lines on hand goal we can increase our supply availability target. Figure 4 reflects a required increase in safety level of $60 M dollars to achieve a projected supply availability of 93%.

Figure 4



C. Analytical Performance Comparisons Using Actual Demands. Steady state projections often tend to provide optimistic forecasts. One contributing factor is the use of forecasted demands. We developed an analytical model to track the performance of both methods over a one year time horizon using historical quarterly demand in lieu of the quarterly forecasted demand. In order to test each method's performance in the actual system, the stock position of record was used to initialize each quarter. Statistics such as the average dollar value of stock on hand, safety level dollar requirements, buy dollar requirements, and the number of buys were captured for each quarter. Two distinct 10% samples of DISC replenishment items were used. Figure 5 presents summarized results of the model analysis for the time frames of FY864-FY873 and FY872-FY881.

Figure 5

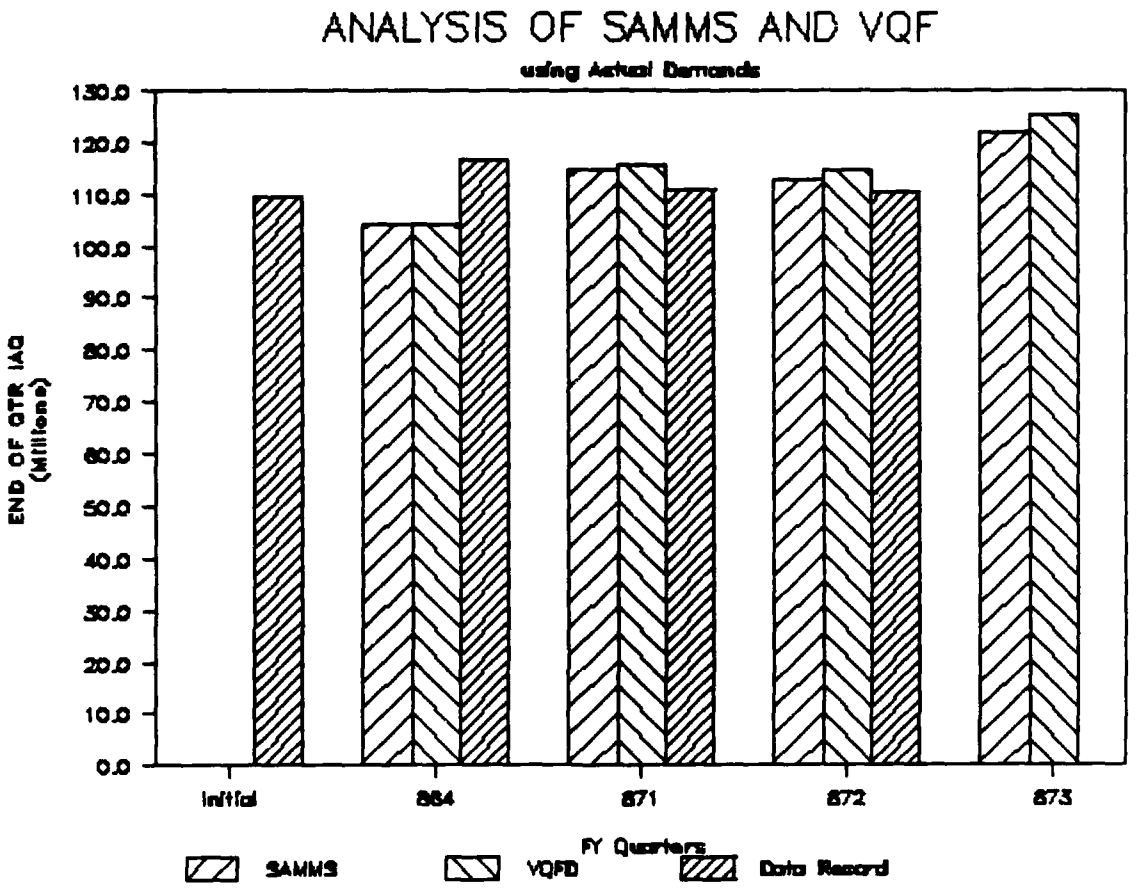
Analysis of SAMMS and VQF
Performance using Actual Demands

	FY872-FY881		FY864-FY873	
	SAMMS	VQF	SAMMS	VQF
# of BUYS	9416	8411	9080	8551
AVSOH ($000)	97491.72	97098.00	90953.87	90882.70
BUY ($000)	53649.03	48953.73	51028.25	47364.54
SL ($000)	5016.90	5134.01	5344.96	5292.77
REQMT ($000)	58665.93	54087.74	56373.21	52657.31
SA%	84.5	84.6	83.8	83.9

As in the steady state projections, each methodology achieved relatively the same supply availability. Again, the VQF methodology realizes lower dollar investments. The number of buys initiated is also less. In the FY872-FY881 analysis, the SAMMS methodology required $53.6 M in commitments compared with $48.9 M for the VQF.

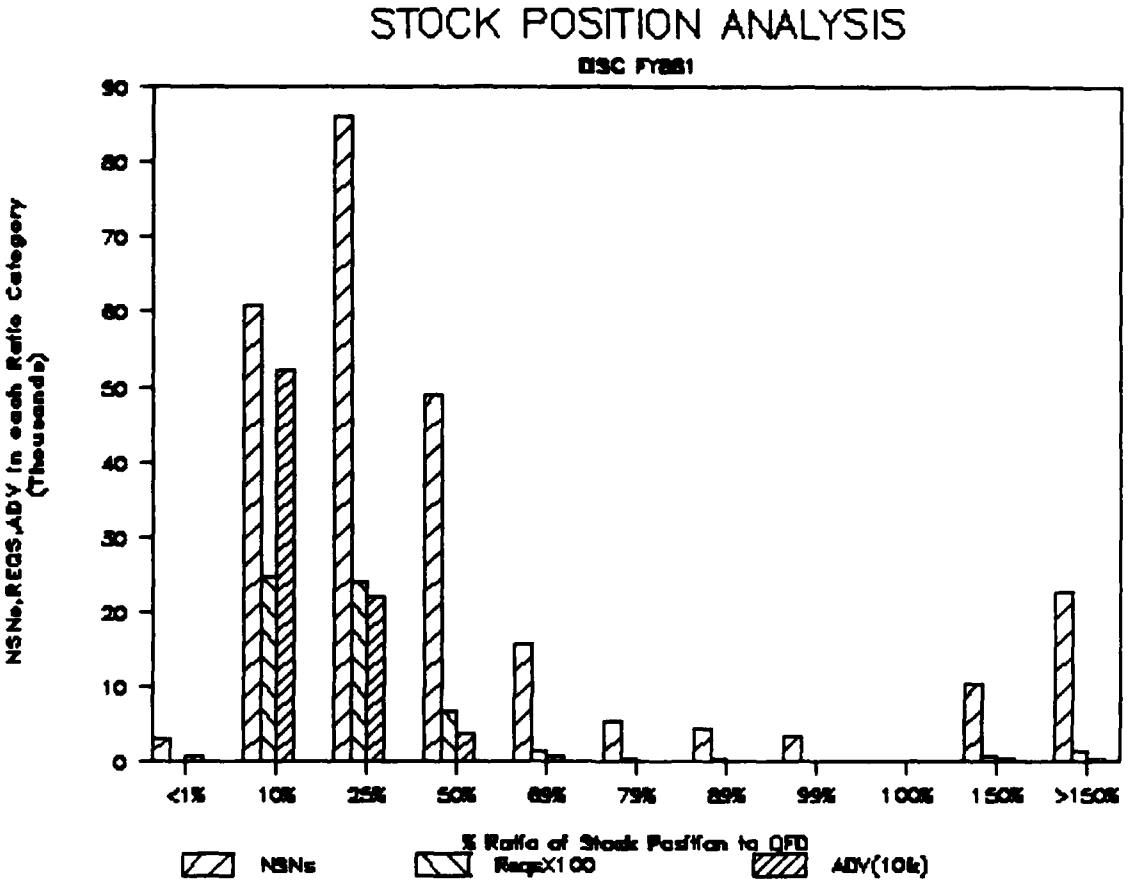
From the quarterly statistics retained for each method, it is evident that factors not readily identified by the model requirements determination process of either method are occurring at DISC. Each method attempts to increase the depth of stock across all items by establishing adequate safety levels to cover variances in demand over leadtimes. Figure 6 displays each method's attempt to increase the quantity of issuable assets compared with the recorded issuable asset quantity (IAQ) at each quarter.

Figure 6



In an attempt to identify additional factors which may be contributing to lower performance, we performed a stock position analysis for FY881. An item's stock position (IAQ of record plus recorded dueins) was compared to its quarterly forecasted demand. Items were grouped according to a percentage ratio of their stock position to their QFD. The number of NSNs falling into each ratio category and their total annual demand value and frequency are presented in Figure 7. The ratio category of 25% represents stock position quantities which were equal to 11-25% of the quarterly forecasted demand. This category contained 86000 NSNS. These NSNs account for 2.4M annual requisitions with a total annual demand value of $221M.

Figure 7



The majority of items do not have enough stock on hand and on order to cover one quarter's forecasted demand. Using the model previously described, we constrained the IAQ of record to a minimum of the reorder point quantity and reevaluated the performance of SAMMS and the VQF. By increasing the available stock on hand, supply availabilities for both methods increased from approximately 84% to 91%. This increase in supply availability required a $16M increase in the average dollar value of stock on hand for the FY864-FY873 sample and a $20M increase for the FY872-FY881 sample. The results of this analysis are presented in Figure 8.

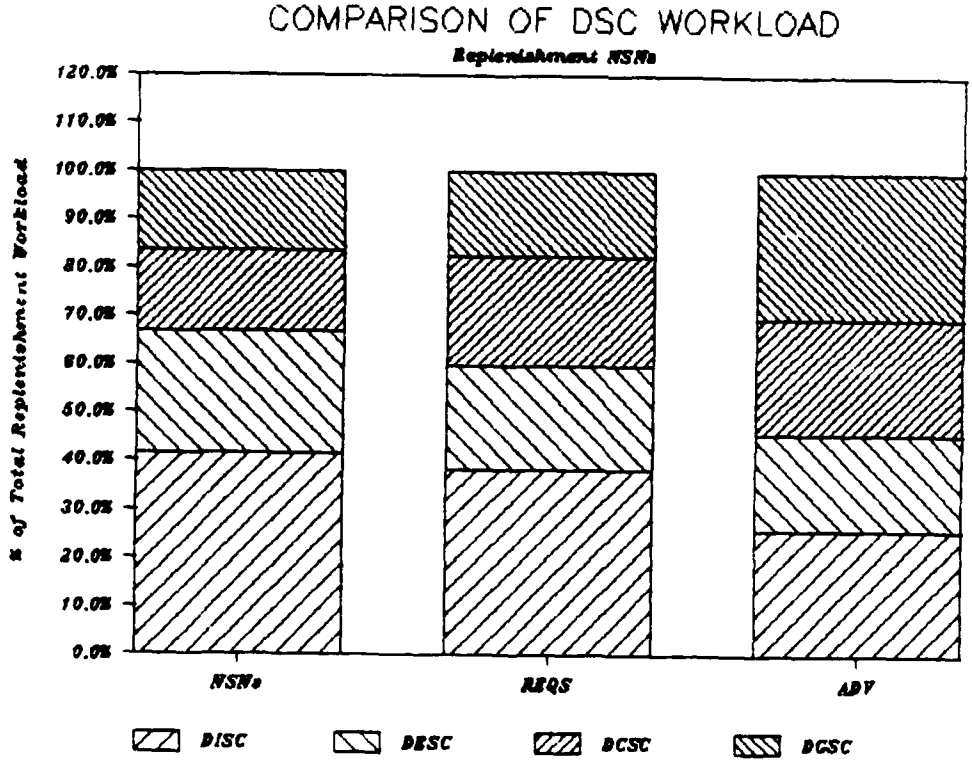
Figure 8

Analysis of SAMMS and VQF
Performance using Actual Demands
Recorded IAQ Increased to Minimum of ROP Q

	FY872-FY881		FY864-FY873	
	SAMMS	VQF	SAMMS	VQF
# of BUYS	7,314	6,644	6,495	6,239
AVSOH ($000)	117,931.22	116,356.28	109,267.69	107,399.89
BUY ($000)	34,299.20	31,589.61	27,883.26	25,805.73
SL ($000)	5,016.90	5,134.01	5,344.96	5,292.23
REQMT ($000)	39,316.10	36,723.62	33,228.22	31,097.96
SA%	91.11	91.02	91.50	91.45

D. Comparison of DSC Workload. The final part of our analysis involved a comparison of the workload at each of the four hardware commodities. Data was extracted from our item header files. DISC is noted as experiencing lower supply availability than the other DSCs. In terms of dollar value of annual demand for replenishment NSNs, DGSC is the highest with a recorded annual demand value of $900M. DISC is second with $800M. However, DISC alone manages 41% of all replenishment NSNs and processes 38% of all replenishment requisitions (Figure 9).

Figure 9



Due to the high volume of requisitions processed, supply performance at DISC has a significant impact on DLA's overall system performance. If we assume supply availability to be 93% at the other DSCs and 85% at DISC, overall DLA supply availability for replenishment NSNs would be 89.9%. If it were necessary to reallocate resources among commodities in order to increase DISC supply availability to 91%, the other commodities could experience a decrease in supply availability to approximately 90.5% providing an overall DLA supply availability for replenishment NSNs of 91%.